

COMPLETE LISTING OF CLAIMS  
IN ASCENDING ORDER WITH STATUS INDICATOR

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1. (currently amended) An image processing apparatus comprising:  
gradient calculation means for calculating at least the direction of the level gradient of each of a plurality of processing unit units in a given image data including a plurality of pixels, the pixels respectively having level data;  
line segment formation means for producing line segment image data representing a line segment for each of the plurality of processing units, each line segment having a given length and a direction corresponding to the direction of the each level gradient which is calculated by said gradient calculation means; and  
line segment image storage means for storing the line segment image data produced by said line segment formation means.
2. (original) The image processing apparatus according to claim 1, further comprising  
image storage means for storing said given image data.
3. (previously amended) The image processing apparatus according to claim 1, further comprising  
image data extraction means for extracting image data in a processing region set in input image data and feeding the extracted image data to said gradient calculation means.
4. (original) The image processing apparatus according to claim 3, further comprising means for setting said processing region.
5. (previously amended) The image processing apparatus according to claim 1, wherein said line segment formation means produces line segment image data at a gray level.
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6. (previously amended) The image processing apparatus according to claim 1,  
wherein  
said line segment formation means produces line segment image data at a binary  
level.

7. (previously amended) The image processing apparatus according to claim 1,  
wherein  
said gradient calculation means calculates the magnitude of the level gradient in  
addition to the direction of the level gradient.

8. (previously amended) The image processing apparatus according to claim 1,  
wherein  
said gradient calculation means calculates the magnitude of the level gradient in  
addition to the direction of the level gradient, and  
said line segment formation means produces line segment image data having a level  
corresponding to the magnitude of the level gradient which is calculated by said gradient  
calculation means.

9. (previously amended) The image processing apparatus according to claim 1,  
wherein  
said gradient calculation means calculates the magnitude of the level gradient in  
addition to the direction of the level gradient, and  
said line segment formation means produces line segment image data only when the  
magnitude of the level gradient which is calculated by said gradient calculation means is not  
less than a predetermined threshold.

10. (previously amended) The image processing apparatus according to claim 1, wherein

said line segment image storage means adds new line segment image data to line segment image data already stored at each of the pixels, and stores the result of the addition.

11. (previously amended) The image processing apparatus according to claim 1, wherein

said line segment image storage means stores new line segment image data without subjecting the line segment image data to addition processing.

12. (previously amended) The image processing apparatus according to claim 1, wherein

said line segment formation means produces a line segment having a predetermined length in a direction corresponding to the calculated direction of the level gradient from the position of the processing unit.

13. (previously amended) The image processing apparatus according to claim 1, wherein

said line segment formation means produces, when the distance from the position of the processing unit to an initial point and the distance from the processing unit to a terminal point are given, a line segment from said initial point to said terminal point in a direction corresponding to the calculated direction of the level gradient.

14. (original) The image processing apparatus according to claim 12, further comprising

means for setting the length of the line segment.

15. (original) The image processing apparatus according to claim 13, further comprising

means for setting at least one of the distance from the processing unit to the initial point and the distance from the processing unit to the terminal point.

16. (previously amended) The image processing apparatus according to claim 1, further comprising

means for detecting a portion where line segments represented by the line segment image data stored in said line segment image storage means are concentrated.

17. (previously amended) The image processing apparatus according to claim 1, further comprising

means for detecting the position of the pixel having the maximum of the levels of the line segment image data stored in said line segment image storing means.

18. (original) The image processing apparatus according to claim 17, further comprising

means for judging whether or not said maximum level exceeds predetermined threshold.

19. (previously amended) The image processing apparatus according to claim 1, further comprising

image input means having a camera for producing image data and feeding the produced image data to said gradient calculation means.

20. (previously amended) The image processing apparatus according to claim 1, further comprising

a display device for displaying a line segment image represented by the line segment image data produced by said line segment formation means or the line segment image data stored in said line segment image storage means.

21. (original) The image processing apparatus according to claim 20, wherein said display device displays an image represented by said given image data with the image overlapped with said line segment image.

22. (original) The image processing apparatus according to claim 20 further comprising  
means for extracting an edge of the image represented by said given image data,  
said display device displaying an image represented by the extracted edge with the image overlapped with said line segment image.

23. (original) The image processing apparatus according to claim 16, further comprising  
a display device for displaying a mark representing the portion, where the line segments are concentrated, detected by said detection means with the mark overlapped with the image represented by said image data.

24. (original) The image processing apparatus according to claim 17, further comprising  
a display device for displaying, at the position of the pixel having the maximum level which is detected by said detection means, a mark indicating that the pixel has the maximum level with the mark overlapped with the image represented by said image data.

25. (original) The image processing apparatus according to claim 18, further comprising  
a display device for displaying, at the position of a pixel having the maximum level which is judged to exceed a threshold by said judgment means, a mark indicating that the pixel has the maximum level with the mark overlapped with the image represented by said image data.

26. (previously amended) The image processing apparatus according to claim 23, further comprising

means for extracting an edge of the image represented by said image data,  
said display device displaying an image represented by the edge extracted by said edge extraction means in addition to or in place of the image represented by said image data.

27. (original) The image processing apparatus according to claim 26, wherein said display device displays the line segment image represented by said line segment image data with the line segment image further overlapped with the image represented by the edge.

28. (currently amended) An image processing apparatus comprising:  
an image processing means for calculating at least the direction of the level gradient of each of a plurality of processing unit units in given image data, and producing line segment data representing a line segment for each of the plurality of processing units, each line segment having a predetermined length and a direction corresponding to the calculated direction of the level gradient for each image data having a non-zero level gradient; and

display means for displaying a the line segment image images represented by the line segment image data produced by said image processing means.

29. (original) The image processing apparatus according to claim 28, wherein said display device displays the image represented by said image data with the image overlapped with said line segment image.

30. (original) The image processing apparatus according to claim 29, further comprising  
means for extracting an edge of the image represented by said image data,  
said display device displaying an image represented by the edge extracted by said  
edge extraction means in addition to or in place of the image represented by said image  
data.

31. (currently amended) An image processing method comprising the steps of:  
calculating at least the direction of the level gradient of each of a plurality of  
processing ~~unit~~ units in given image data including a plurality of pixels, the pixels  
respectively having level data;

producing line segment image data representing a line segment for each of the  
plurality of processing units, each line segment having a predetermined length and a  
direction corresponding to the calculated direction of the level gradient for each pixel  
having a non-zero level gradient; and

storing the produced line segment image data in storage means.

32. (currently amended) A medium storing a program for controlling a computer  
so as to:

calculate at least the direction of the level gradient of each of a plurality of  
processing ~~unit~~ units in given image data including a plurality of pixels, the pixels  
respectively having level data;

produce line segment image data representing a line segment for each of the  
plurality of processing units, each line segment having a predetermined length and a  
direction corresponding to the calculated direction of the level gradient for each pixel  
having a non-zero level gradient; and

store the produced line segment image data in storage means.

33. (currently amended) An image processing method comprising:  
 calculating at least the direction of the level gradient of each of a plurality of  
 processing ~~unit~~ units in given image data, ~~and~~;  
 producing line segment image data representing a line segment for each of the  
plurality of processing units, each line segment having a predetermined length and a  
 direction corresponding to the calculated direction of the level gradient for each image data  
 having a non-zero level gradient; and  
 displaying a line segment ~~image~~ images represented by the produced line segment  
 image data on a display device.

34. (currently amended) A medium storing a program for controlling a computer  
 so as to:

calculate at least the direction of the level gradient for each of a plurality of  
 processing ~~unit~~ units in given image data, and produce line segment image data  
 representing a line segment for each of the plurality of processing units, each line segment  
 having a predetermined length and a direction corresponding to the calculated direction of  
 the level gradient for each processing unit having a non-zero level gradient; and  
 display a line segment ~~image~~ images represented by the produced line segment  
 image data on a display device.

35. (previously amended) An image processing apparatus comprising:  
 means for extracting a plurality of edges whose level gradients are not less than a  
 predetermined value in given image data;  
 means for setting, for each of the edges, a line segment extending a predetermined  
 length in a direction corresponding to the direction of the extracted edge; and  
 means for detecting the presence or absence of a point of intersection of a plurality  
 of line segments and the position thereof.



36. (original) The image processing apparatus according to claim 35, wherein the direction of the line segment is a direction perpendicular to the direction of the edge or the same direction as the direction of the edge.

37. (currently amended) An inspection apparatus comprising:  
image input means for inputting image data representing an inspection object;  
means for calculating at least the direction of the level gradient of each of a plurality of processing unit units in said input image data, and producing line segment image data representing a line segment for each of the plurality of processing units, each line segment having a direction corresponding to the calculated direction of the level gradient; and  
means for detecting the presence or absence of a portion where the line segments ~~segment images~~ are concentrated or are overlapped with one another and the position thereof on the basis of the produced line segment image data.

38. (original) The inspection apparatus according to claim 37, wherein the direction corresponding to the direction of said level gradient is the direction of the level gradient or a direction perpendicular to the direction of the level gradient.

39. (original) The inspection apparatus according to claim 38, further comprising a display device for displaying the line segment image on the basis of said line segment image data.

40. (original) The inspection apparatus according to claim 39, wherein said display device displays an image of the object represented by said input image data with the image overlapped with the line segment image.

41. (previously amended) The inspection apparatus according to claim 37, further comprising

a display device for displaying the detected position of the portion where the line segment images are concentrated or are overlapped with one another on the image of the

object represented by said input image data or an image represented by an edge extracted from said input image data.

42. (previously amended) The inspection apparatus according to claim 37, further comprising

means for inputting data relating to the length of the line segment or the initial point and the terminal point of the line segment.

43. (previously added) The image processing apparatus according to claim 1, wherein the direction of the level gradient is a direction of a composite vector of a vector having a level gradient along the X axis and a vector having a level gradient along the Y axis.

44. (previously added) The image processing apparatus according to claim 28, wherein the direction of the level gradient is a direction of a composite vector of a vector having a level gradient along the X axis and a vector having a level gradient along the Y axis.

45. (previously added) The image processing apparatus according to claim 35, wherein the direction of the level gradient is a direction of a composite vector of a vector having a level gradient along the X axis and a vector having a level gradient along the Y axis.

46. (previously added) The image processing apparatus according to claim 37, wherein the direction of the level gradient is a direction of a composite vector of a vector having a level gradient along the X axis and a vector having a level gradient along the Y axis.

47. (new) The image processing apparatus according to claim 1, further comprising line segment image processing means for processing line segment image data stored in the line segment image storage means.

48. (new) An image processing apparatus comprising:  
a gradient calculator which calculates at least the direction of the level gradient of a processing unit in a given image data including a plurality of pixels, the pixels respectively having level data;  
a line segment former which produces line segment image data representing a line segment having a given length and a direction corresponding to the direction of the level gradient which is calculated by said gradient calculation means; and  
line segment image storage which stores the line segment image data produced by said line segment formation means.